LIGHTNING ARRESTOR

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Engineering Department

WEST BENGAL STATE ELECTRICITY TRANSMISSION COMPANY LIMITED
পশ্চিমবঙ্গ রাজ্য বিদ্যুৎ সংবহন কোম্পানি লিমিটেড
(পশ্চিমবঙ্গ সরকারের একটি উদ্যোগ)

Regd. Office: VidyutBhawan, Block – DJ, Sector-II, Bidhannagar, Kolkata – 700091.

CIN: U40101WB2007SGC113474; Website: www.wbsetcl.in

Updates for WBSETCL / TECH SPEC / Rev.-3.1

1. The clause 4. (d)

   This line is added, "The reference current will be typically in the range of 0.05mA to 1 mA per sq. cm of disc area of single column arrester (instead of 0- 2 mA for safe zone leakage current of LA)."

2. SPECIFIC TECHNICAL PARAMETERS

   The Minimum creepage Distance value is fixed at 31 mm/KVfor all voltage classes.

TECHNICAL SPECIFICATION FOR LIGHTNING ARRESTORS

1. SCOPE:

a) This Specification covers design, manufacture, testing at manufacturer's Works of all classes of gapless Lightning Arrestors complete with fittings and accessories.

b) These arrestors shall be of heavy duty, station class and gapless zinc Oxide type.

c) Arrestors shall be hermetically sealed units suitable for outdoor installation on self-supporting base or structures to be supplied by the bidder.

2. STANDARD:

Arrestors shall conform in general to IEC-99-4 document or its latest amendment and IS/IEC as follows:

i) IEC-99-4: Gapless Lightning Arrestor
ii) IS 3070 P-III: Metal Oxide Surge Arrestors without gaps for AC Systems.
iii) IEC 99 P-III : Artificial Pollution Testing of Lightning Arrestor
iv) IEC 270 : Partial Discharge Measurement.
v) IS 2071 : Methods of H V Testing
vi) IS 6209 : Methods for Partial Discharge Measurement
vii)IS 5621 : Hollow Insulators for use in electrical equipment

3. I) DEVIATION:

Normally the offer should be as per Technical Specification without any deviation.

II) MODIFICATION:

If any modification felt necessary to improve performance, efficiency and utility of equipment, the same must be mentioned in the 'Modification schedule' with reasons duly supported by documentary evidences and advantages. Such modifications suggested may or may not be accepted, but the same must be submitted along with Pre-Bid Queries. The modifications not mentioned in Schedule will not be considered.

4. DUTY REQUIREMENT:

The Surge Arrestors are being provided to protect the following equipment whose insulation levels are indicated in the table given below:

Equipment to be protected	Switching surge (KVp) for 420KV System	L1 for 420KV System (KVp)	L I for 245 KV system (KVp)	L I for 145 KV system (KVp)	L I for 36 KV system (KVp)
Power Transformer	± 1050	± 1300	± 950	±550	±170
Instrument Transformer	± 1050	± 1425	± 1050	±650	±170
Circuit Breaker	± 1050	± 1425	± 1050	±650	±170
Isolator Phase to ground	± 1050	± 1425	± 1050	±650	±170
Isolator Across open poles	± 900 (-/+ 345)	± 1425 (-/+ 240)	±1200	±750	±195
Reactor	± 1050	± 1300	-	-	-
XLPE cable	± 1050	± 1425	± 1050	±650	±170

a) The Lightning Arrestors shall be capable of discharging Lightning and switching surges and temporary power frequency over voltages. The Surge Arrestor shall be capable of discharging over voltages occurring during switching of unloaded transformers, Reactors and long lines.

b) The Arrestors shall be capable of withstanding Maximum Continuous Operating Voltages (M.C.O.V).

c) The Arrestors supplied shall be suitable for heavily polluted atmosphere.

d) The reference current of the Arrestors shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltages.The reference current will be typically in the range of 0.05mA to 1 mA per sq. cm of disc area of single column arrester(instead of 0- 2 mA for safe zone leakage current of LA).[R3.1]

e) The Surge Arrestor shall be suitable for duty cycle of circuit breaker in this system.

5. FITTINGS &ACCESSORIES:

a) Arrestors of rating 120 KV and above shall be complete with insulating base for connection to surge counter having provision for bolting to flat surface of structure. Arrestor rating of 42 KV shall be directly mounted on structure as there is no surge counter.

b) For arrestors of rating 120 KV and above, self-contained discharge counters suitably enclosed for outdoor use shall be provided for each single pole unit and placed on the Arrestor Structure, but requiring no auxiliary or battery supply for operation. The Cyclometer counter reading shall clearly visible through an inspection window. The counter terminals shall be robust and of adequate size and shall be so located that incoming and outgoing connections can be made with minimum no. of bends. The inspection window shall be sealed instead of screwed to prevent ingress of moisture.

c) Suitable leakage current monitor on each pole of the arrestors with appropriate connections shall be supplied to measure leakage currents, for monitoring of 120 KV and above class of arrestor. The reading of Milliammeter and counters shall be visible through an inspection glass panel.

d) Grading ring/Corona ring shall be provided for Arrester rating of 120KV & above arrester for achieving linear voltage distribution along the Arrester column. Material of Grading ring/Corona ring shall be of Al or better-quality material.

e) Each single pole arrestor shall be provided with suitable name plate, at the base with the following data:

i) Name of device
ii) Manufacturer's name and trade mark, type and identification
iii) Year of manufacture
iv) Voltage rating & frequency rating.
v) Nominal discharge current
vi) MCOV (Maximum Continuous Operating Voltage in KV).
vii) Discharge class.
viii) Energy Discharge capability (KJ/KV rating)
ix) Purchase Order reference.
x)Applicable Standard.
xi)Pressure Relief current in KA rms (for arrestors fitted with Pressure Relief device)
xii)Serial Number

f) Required connectors and fixtures for L.A. leakage current monitor and discharge counter shall be supplied along with the L.As.

g) Terminal connector shall be suitable for either ACSR Moose (single moose or double moose as per requirement) / ACSR Panther conductor for 400KV, 220 KV, 132 KV and 33 KV system voltage class L.A. having universal take off. Detailed particulars of Clamps and Connectors shall be guided by the specification for Clamps and Connector in this bid document.

h) Two ground terminal suitable for G.I flat of required sizes shall be provided on diagonally opposite sides.

i) Necessary hardware such as nuts, bolts, spring washers, etc. shall be supplied for different units.

j) Surge monitor consisting of discharge counter and milliammeters should be suitable to be mounted on Support Structure of the arrester and should be tested for IP:55 degree of protection. Surge Monitors shall be connected in series with Surge Arrestor at a height approx. 1.5 meter from ground level. The cable used for connecting Surge Arrestor to Surge Monitor and ground is to be insulated from the structure by insulated cable.

6. CONSTRUCTIONAL FEATURES:

a) The arrestor elements shall be designed in such a way as to obtain robust construction with excellent mechanical and electrical properties even after repeated operation. The lightning arrestors should be adequately designed to operate satisfactorily under temporary power frequency over voltage as given in Specific Technical Parameters, after discharging two shots of respective long duration surges. Uniform density of zinc oxide element shall be maintained to provide uniform current distribution.

b) The lightning Arrestors shall be of adequate Pressure Relief Class as per IEC-99-4, fitted with Pressure Relief Devices and Arc diverting ports to minimise possibilities of shattering of porcelain housing and providing path for flow of rated fault currents in the event of arrestor failure.

c) Sufficient creepage distance shall be provided to reduce excessive uneven voltages over the porcelain due to contamination, for which the arrestor shall not fail.

d) Seals shall be provided in such a way that these are always effectively maintained even when discharging the maximum rated lightning current.

e) Housing Insulators shall be of porcelain, glazed and completely vitrified and free from blow holes, micro-cracks or voids. Porcelain housing shall be so coordinated that external flashover will not occur due to application of any impulse or switching surge voltage up to the maximum design value for the arrestor.

f) The end fittings shall be made of non-magnetic and corrosion proof material. LAs shall be hermetically sealed. Arrestors shall be suitable for mounting on a support structure.

g) There shall be minimum number of arrestor units for lightning arrestors of 120 KV rating and above. For 42KV and below single arrestor unit is preferred.

7. APPLICATION:

The lightning Arrestors are used for protection of incoming and outgoing line and also of the power transformers from lightning surge as well as from power frequency over voltage.

8. GROUNDING TERMINALS:

Two grounding terminals on diagonally opposite sides of adequate size suitable for connecting G.S. Flat of 50×10mm shall be provided for all voltage classes.

9. GUARANTEE:

Electrical characteristics shall be guaranteed by the bidder. In case of failure of materials to meet the guarantee, WBSETCL shall have right to reject the material. Guaranteed Technical Particulars are to be submitted by successful bidder during detailed engineering alongwith submitted drawings/documents. However, format for submission of GTP shall be handed over to intending bidders at the time of sale of tender documents.

10. CONTRACT DRAWINGS AND MANUALS:

A. In the event of placement of L.O.A., six (6) copies of drawings and descriptive literatures shall be furnished for approval:

a) General Outline drawing showing plan, elevation and end views with dimensions & full mounting details with weights.

b) Dimensional Drawing showing the Arrestor mounted on its base and where applicable with surge counter and leakage current measuring meter.

c) Details of Bushing top terminals.

d) Shipping dimension with weights.

e) Position of Centre of gravity and clearances with adjacent grounded metallic structures.

f) Diagram plate showing electrical connections of the surge counter and leakage current measuring meter where applicable.

g) Diagram plate showing electrical connections of the surge counter and leakage current measuring meter where applicable.

h) Rating Plate.

i) Complete foundation drawings for the structure of Lightning arrestor, where applicable.

B. Four (4) sets of approved drawings and operation and maintenance manuals both in hard and soft copy shall be submitted for our record and distribution to site.

11. TEST AT FACTORY AND TEST CERTIFICATES:

a) Each LA. shall comply with the requirements of routine test as specified in the relevant IEC:99-4 & IS:3070 (Part - III).

b) All Routine test at manufacturer's works shall be carried out for all LA's and Test reports are to be submitted.

c) All acceptance tests shall be carried out at the manufacturer's works on every lot offered for inspection as per relevant IEC & IS in presence of representative of WBSETCL. Selection of samples for acceptance test as well as rejection and retesting shall be guided by relevant IEC & IS. The entire cost of acceptance and routine tests that are to be carried out as per relevant IEC & IS shall be treated as included in quoted price of LA. Three (3) copies of test reports shall be submitted for approval and adequate extra copies for distribution to site.

d) The contractor shall give at least 15 (fifteen) days' advance notice intimating the actual date of inspection and details of all tests that are to be carried out.

12. TEST REPORTS AND TYPE TESTS:

Only type tested L.A's are to be offered for 400KV, 220KV, 132KV & 33KV System Voltage conforming to our technical specification and relevant IS and IEC. L.A offered should be similar with ones on which type testing has been carried out as per relevant IS and IEC. Three sets of complete type test reports carried out in Govt. recognized Test House or Laboratory /NABL accredited laboratory shall have to be submitted by successful bidder positively alongwith submission of drawings during detailed Engineering. Successful bidder may require to produce original copies type test reports at the time of detail Engineering if asked by WBSETCL. Each type test report shall comply the following information with test result

i) Complete identification, date and serial no.

ii) Relevant drawings as documented with test report.

iii) Method of application, where applied, duration and interpretation of each test.

SPECIFIC TECHNICAL PARAMETERS

SNO	DESCRIPTION	TECHNICAL PARAMETERS			
	TYPE OF ARRESTOR	STATION CLASS HEAVY DUTY GAPLESS			
i)	Nominal system voltage (KV)	400	220	132	33
ii)	Highest system voltage (KV)	420	245	145	36
iii)	System Neutral Earthing	EE	EE	EE	Earth with Earthing Transformer
iv)	BIL of transformers (KVp)	1300	900	550	170
v)	System fault level (KA) for 3 sec.	50 for 1 sec.	40 For 3 sec.	31.5 For 3 sec.	25 For 3 sec.
vi)	Lightning Impulse withstand voltage for arrestor housing (KVp)	1425	1050	650	170
i)	Rated Voltage (KV)	360or as specified in the schedule	198	120	42
ii)	Maxm. Continuous operating voltage (KVrms)	306	168	102	36
iii)	Nominal Discharge Current (KAp) of 8/20 micro second wave	10/ 20	10	10	10
iv)	Line discharge class	3	3	3	2
v)	Minimum Energy Discharge capability (KJ/KV) at rated	10	7.5	7.5	5

	voltage.				
vi)	Temporary over voltage withstand capability (KVrms) for 10.0 secs	360 or as specified in the schedule	198	120	42
vii)	Insulation Housing withstand voltages i)Lightning Impulse (Dry) ii)Power frequency(wet) for 10 KA for 5 KA	As per IEC 60099-4			
viii)	Minimum creepage Distance (mm) (31 mm/KV) [R3.1]	~~10500~~13020	~~6125~~7595	~~3625~~4495	~~900~~1116
ix)	Pressure Relief Class	← A →			
x)	(Minimum) High Current Impulse withstand (4/10 micro second wave) KA (peak)	100	100	100	100
xi)	Maxm. Lightning Impulse (8/20 micro-second Wave) residual voltage (KVp) 5KA 10KA	 800 850	 517 550	 320 340	 112 120
xii)	Maxm. switching surge (30/60 micro-second wave) protective level (KVp)				
	500 Amps 1000 Amps 2000 Amps	- - 750	- 455 -	- 280 -	98 - -
xiii)	Maxm. Steep Impulse (1/20 MS impulse) residual voltage at 10 KA (KVp)	1050	600	372	130
xiv)	Partial Discharge(picocoulomb) when energized at 1.05 times its continuous operating voltage.	Not exceeding 10 PC			
xv)	Rated Frequency (Hz)	50			
xvi)	Minm. visible corona discharge voltage (KVrms)	320	-	-	-
xvii)	Min. Bending load (kgm)	1000	1000	500	500
xviii)	1 min. p.f. withstand (KVrms) voltage (dry & wet) for arrestor housing	630	460	275	70

xix)	Switching Impulse withstand voltage (250/2500 micro second) dry & wet for arrestor housing (KVp)	±1050	-	-	-
xx)	Pressure relief Current i) High Current (KA rms)	40	40	40	40
	ii) Low Current (KA rms)	As per IEC			

GUARANTEED TECHNICAL PARTICULARS FOR LIGHTNING ARRESTORS

(To be filled in and signed by the Bidder)

SL	DESCRIPTION	FOR 400 KV	FOR 220 KV	FOR 132KV	FOR 33KV
1	LA : GENERAL				
1.01	Name of Manufacturer				
1.02	Type & Model of the Manufacturer				
1.03	Conforming Standard				
1.04	Date of Last Type Test				
1.05	Diameter of Primary Stud (mm)				
1.06	Total Height of the LA				
1.07	Total Weight of the LA				
1.08	No. of Units per Arrestor				
2	LA: VOLTAGE				
2.01	Rated voltage of Units				

2.02	MCOV				
2.03	Switching Surge Impulse withstand voltage with 250/2500 micro sec. wave(KVp)				
2.04	Lightning Impulse Residual voltage (KVp) (8/20 microsecond wave)				
2.05	Temporary over voltage capability (KVrms)				
2.05.1	0.1 seconds				
2.05.2	1.0 seconds				
2.05.3	10.0 seconds				
2.05.4	100.00 seconds				

2.05	Residual voltage after passing a steep current (1 microsecond front time) with amplitude equal to Nominal Discharge Current				
2.06	Residual voltage for switching impulse currents (front time of about 30 to 60 microseconds) in KV crest at 500/1000 Amps				
2.07	Maximum RIV at 1.1 Ur/ √3 voltage at 1 MHz (Micro volts)				
3	LA: CURRENT				
3.01	Nominal Discharge Current (KAp) (for a 8/20 microsecond wave)				
3.02	High current Impulse withstand capacity(4/10 microsecond) in Kap				
3.03	Ir at MCOV				
3.04	Ic at MCOV				
4	LA : ENERGY				

4.01	Minimum energy discharge capability(KJ/KV) at				
4.02	Long duration discharge class				
4.03	Pressure Relief Class				
5	Protective Ratio based on Transformer/Reactor BIL.				
5.01	5000 Amps				
5.02	10,000 Amps				
6	LA: HOUSING				
6.01	Material of Housing Insulator				
6.02	Total Creepage Distance of whole Arrestor housing (mm)				
6.03	Cantilever strength of complete Arrestor(Kgf)				
6.04	L.A. Housing Insulation Withstand (KV)				
6.05	Dry(P.F)				
6.06	Wet (P.F)				
6.07	Lightning Impulse (Dry)				
6.08	Partial Discharge in Pico-Coulomb				
6.09	Corona Extinction Voltage (KVrms)				
6.10	Type of Surge Monitor				
6.11	Each ZNO Block Dimensions				